

REMARKS

Claims 3, 5-9, and 11-12 are pending in this application. Applicants have redrafted claim 3 into independent form, and accordingly, have canceled claim 1. Additionally, Applicants have amended claims 5-7 and 12 to depend from claim 3, rather than from claim 1, and have cancelled claims 13 and 14 without prejudice or disclaimer. Applicants respectfully request reconsideration and allowance in view of the above amendments and the following remarks.

Entry of this Amendment is proper under 37 CFR §1.116 since the Amendment: (a) places the application in condition for allowance (for the reasons discussed herein); (b) does not raise any new issue requiring further search and/or consideration, since all of the features recited in amended claim 3 were previously considered with respect to claim 1; (c) satisfies requirements of form asserted in previous Office Actions; and (d) places the application in better form for appeal, should an appeal be necessary. The Amendment is necessary and was not earlier presented because it was made in response, at least in part, to arguments raised in the Final Rejection. Entry of the Amendment is thus respectfully requested.

Claims 1, 3 and 5-13 are rejected under 35 U.S.C. §103(a) as being unpatentable over EP 849 591 in view of EP 120 423, and one of Taylor et al., U.S. Patent No. 4,457,808, Bryan, U.S. Patent No. 4,822,456, or Kida et al., U.S. Patent No. 5,989,614. Because claims 1 and 13 are canceled, the rejection is technically moot with respect to those claims. Applicants respectfully traverse the rejection with respect to the other claims.

Independent claim 3 relates to a gas concentration measuring apparatus in which “a microcomputer [is] disposed within a connector configured to connect the microcomputer to an external device” and in which the “microcomputer includes an impedance measuring circuit measuring an impedance of [a] sensor element of [the] gas concentration sensor and

[the] microcomputer controls a power supply to a heater which heats the sensor element.”

The microcomputer controls the power supply “as a function of the measured impedance.”

In making the rejection, the Examiner admits in paragraph 4 of the Office Action that “the references EP (‘591) and EP (‘423) do not teach the use of a microcomputer for the signal processing circuit. The reference teaches the use of analog circuitry.” The Examiner asserts that the Taylor et al., Bryan, and Kida et al. references teach the use of a microprocessor as recited in claim 3. Applicants respectfully disagree.

Taylor et al. relates to a type of liquid electrochemical sensing cell that is not analogous to the type of gas concentration sensing apparatus recited in claim 3. Bryan relates to a similarly non-analogous type of liquid electrochemical cell. Kida et al. merely suggests that the voltage applied to an electrochemical cell may be controlled by a microcomputer.

None of the cited references, either alone or in any proper combination, teaches or suggests all of the advantageous features recited in claim 3. In particular, none of the references discloses a microcomputer disposed within a connector to control a power supply of a heater in accordance with a measured impedance value of a gas concentration sensing cell. In fact, Applicants note that the non-analogous liquid electrochemical sensors according to the Bryan and Taylor et al. references are not even designed for the same environmental extremes (i.e., high-temperature motor vehicle engine) as are sensors according to claim 3.

For at least the foregoing reasons, Applicants submit that claim 3 is patentable over the cited combination of references. Moreover, Applicants submit that claims 5-9 and 11-12, which depend from claim 3, are patentable over the cited combination of references for at least the same reasons as claim 3, as well as for the additional features that each of these claims recites. Accordingly, Applicants respectfully request that the rejection be withdrawn.

Claim 14 is rejected under 35 U.S.C. §103(a) as being unpatentable over EP '591 in view or EP '423 and one of Taylor, Bryan, and Kida, and further in view of Miyata et al, U.S. Patent No. 6,214,207. Because claim 14 is canceled, Applicants respectfully submit that the rejection is moot.

In view of the foregoing, Applicants submit that all claims are in condition for allowance, and timely notice to that effect is respectfully requested.

Respectfully submitted,
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Enclosure: Appendix

APPENDIX

Version with markings to show changes made

The claims are amended as follows:

3. (Twice Amended) [A gas concentration measuring apparatus as set forth in claim

1,] A gas concentration measuring apparatus comprising:

a gas concentration sensor having a sensor element outputting a signal as a function of
concentration of at least one of NO_x, HC, and CO;

a microcomputer disposed within a connector configured to connect the
microcomputer to an external device; and

a conductor electrically connecting said gas concentration sensor and said
microcomputer for transmission of the signal from said gas concentration sensor to said
microcomputer;

wherein the microcomputer is configured to process the signal outputted from said gas
concentration sensor to produce a voltage signal indicative of the concentration of said at
least one of NO_x, HC, and CO; and

wherein said microcomputer includes an impedance measuring circuit measuring an impedance of the sensor element of said gas concentration sensor and said microcomputer controls a power supply to a heater which heats the sensor element,

said microcomputer controlling said power supply as a function of the measured impedance.

5. (Twice Amended) A gas concentration measuring apparatus as set forth in claim

[1] 3, wherein the gas concentration measuring apparatus is mounted in a vehicle, and wherein said microcomputer outputs said signal to a vehicular engine electronic control unit by serial communication.

6. (Twice Amended) A gas concentration measuring apparatus as set forth in claim [1] 3, wherein said sensor element includes a first cell responsive to application of a voltage to discharge oxygen contained in the gasses outside said gas concentration sensor, producing a first electric current as a function of concentration of the discharged oxygen and a second cell responsive to application of a voltage to produce a second electric current as a function of concentration of a specified gas component contained in the gasses from which the oxygen is discharged by the first cell.

7. (Twice Amended) A gas concentration measuring apparatus as set forth in claim [1] 3, wherein said microcomputer compensates for unit-to-unit variation in the characteristics of said gas concentration sensor.

12. (Twice Amended) A gas concentration measuring apparatus as set forth in claim [1] 3, further comprising
an impedance measuring circuit measuring an impedance of a sensor element of said gas concentration sensor,
a heater which heats a sensor element of said gas concentration sensor, and a heater control circuit which controls a power supply to said heater,
and wherein said microcomputer, said impedance measuring circuit, and said heater control circuit are formed on a bare chip mounted on a ceramic substrate.